Beyond Mood Congruence: Effects of Music on Memory in Film

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Effects of Music on Objective and Emotional Memory in Film

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Contents

Abstract

Like it or not, music is everywhere. Our lives are accompanied by an omnipresent personal soundtrack—whether we are on our way to work, at the grocery store, at a movie, watching TV, or simply relaxing at home. It seems that the only way human beings have been able to tolerate this extraneous stimulus is, simply, by not consciously attending to it. Otherwise, we would most likely crash our cars, purchase the wrong items at the store, and never quite understand what happened in that movie we had just seen. Despite the technological advances in music recording and production (and, in turn, availability), very little psychological research has focused on the effects of music processing (especially at the unconscious level) on memory consolidation and storage. What previous memory research *has* shown is that human beings tend to exhibit an attentional enhancement for emotional stimuli when presented alongside non-emotional stimuli (Reisberg & Heuer 2004). Specifically, this finding has demonstrated that emotional events promote memory for "central" components of an event, while having a reverse effect for an event's "periphery." In the current study, I employed the medium of film in order to apply this hypothesis to our musical world. Participants were randomly assigned to one of three groups: 1) a "no music" group, in which participants viewed a film clip in silence; 2) a "with music" group, in which participants viewed the same clip with the film's original, low-quality (and low arousal) recorded soundtrack; and 3) a "re-mastered music" group, in which participants viewed the film clip with a higher quality (and higher arousal) soundtrack. Three main results were found, all of which either aligned with or extended the findings of Reisberg & Heuer to include the domain of music as a modulatory force in the formation of emotional memories.

Keywords: music, memory, arousal, emotion, film

Acknowledgements

For the past year and a half, this project has been my academic child – from the very first ideas to the last analyses, it has truly been something to call my own. Since these first meetings and discussions nearly a year and a half ago, the study has evolved tremendously. Today, it is hard to believe that the vague ruminations that had populated my mind while first attempting to come up with a way to empirically study the phenomenon of environmental music have been realized through this project. Nevertheless, it has been a true labor of love, and I have greatly enjoyed engaging with the process for the very first time as an independent researcher.

With that being said, the conception, refinement, and ultimate success of this project could not have been achieved without the unyielding support of a group of advisors and mentors who have made me into the student I am today. I would like to thank Ph.D. candidate Thalia Goldstein for providing me with my first opportunity to sink my teeth into psychological research two years ago – it was my work as a research assistant under her direction that has enabled me to successfully carry out independent research of my own. Likewise, I would also like to thank Ph.D. candidate Katherine Mickley for her guidance and support during the summer of 2007 and beyond. Katherine has been a wonderful mentor, collaborator, and friend, and I owe much of who I am as an aspiring researcher to the time I was fortunate enough to spend with her last year.

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Foreword

Last year, I had the privilege of watching and listening to legendary film composer John Williams conduct excerpts from Bernard Herrmann's revolutionary film score to the movie *Psycho* with the Boston Pops Orchestra. It seemed strange to include music from such an outdated film in a program that was largely focused on Williams' more recent works from *Harry Potter*, *Indiana Jones* and *Star Wars*. Although I had seen the infamous "shower scene" from Hitchcock's 1960 masterpiece countless times, listening to its music performed live under the baton of one of the world's most prolific film composers truly gave it new meaning to me. More importantly, I realized why it deserved to be performed among some of the greatest film music of my lifetime.

Prior to performing the piece, Williams prefaced Herrmann's most famous musical theme with a little bit of anecdotal history. Shortly after the release of *Psycho* (1960), Williams remarked that famed director and producer Alfred Hitchcock was approached by a censor who had a major complaint with the gruesome scene in which Marion – the film's central character – is brutally murdered while in the shower of a roadside motel. For the time, the scene was quite graphic, and Hitchcock acknowledged that changes may be in order. However, rather than changing the nature of the film's action, such as limiting the amount of actual violence portrayed on-screen, he simply removed Herrmann's music from the scene. Upon receipt of the revised scene, without changing any of the film's visual content whatsoever, the censor approved the changes, and the scene was no longer deemed too gruesome for audiences to experience.

Thankfully, Herrmann's musical score was ultimately preserved as an integral part of the "shower scene," as well as the success of *Psycho* as a whole. This story highlights the power of a musical soundtrack. Music has the ability to take something meaningless and allow it to touch the human soul. It may be fear, it may be melancholy, it may be hope, it may be joy – but whatever it is, music serves as a pathway to our emotions. Although the field of film composition is less than a century old, it already has made an indelible impact on the development of media into the twenty-first century. It has become an institution of its own and a critical component of any memorable night at the movies.

JSR

I. Introduction

Music surrounds us. We hear it in our cars; we hear it in the grocery store; we hear it at shopping malls, restaurants and religious services; and we hear music in our homes. Even at sporting events, music has become an essential part of any game-day experience: when was the last time a professional baseball game was played without a performance of "Take Me Out to the Ballgame" during the seventh-inning stretch, or since September 11th, a rendition of "God Bless America?" Going through a day in any major city, the question beckons us: when did music leave the concert hall, and become such an omnipresent soundtrack to our daily environment? Whether or not this growth is good or bad is a question of both theoretical and practical importance, but at the end of the day, it depends on who you ask.

Appropriate or not, gratuitous or acceptable, music does not seem to be going anywhere – at least not anytime soon. Satellite radio provides us with more and more options for what we have the opportunity to listen to on our way to work, if we so desire, and portable electronic devices such as iPods allow us to take our favorite bands and artists with us wherever we go. The music industry is booming – there is no question about that. However, with this unparalleled dissemination of sound from the instruments and voices of recording artists into our car speakers, wave radios and noise-canceling headphones, a new question is emerging amidst this musical proliferation: we hear music all of the time, but how much of the music that we *hear* is music that we're actually *listening* to?

Though we often use *hearing* and *listening* interchangeably in daily conversation, it is important to distinguish between the two terms. The word "hear" is defined as a physical, auditory phenomenon: "to perceive by the ear" (Dictionary.com), and by this definition, we hear lots of things during our everyday experience. Depending on where we live and work, this is likely to vary, but some things that we all hear throughout our lives include crying babies,

automobiles passing by, and nighttime cricket sounds. Unless you are the mother of the baby, a classic car enthusiast, or a biologist interested in nocturnal insect communication, these are generally not things that demand our attention, and thus, we merely *hear* them as they happen.

On the contrary, *listening* suggests a much more active role on our part – we define it as follows: "to give attention with the ear" (Dictionary.com). In giving our attention, we say that whatever it is we are listening to is something of interest to us, and something worthy of our limited attentional resources. In stating that we enjoy *listening* to a piece of music, we are implying much more than simply being able to perceive with our ear the sounds produced by a group of musicians. Rather, listening connotes a much more personal involvement with an auditory stimulus – listening requires us to focus (at least to some degree) on whatever it is we have deemed significant enough to garner our attention. We listen to the morning news, gossip exchanged between our friends, stories told by our family members, and lessons given by our teachers; provided we have the time, we also listen to music.

This dichotomy between listening and hearing has created a unique platform from which music may be approached as a growing environmental force. While some music is listened to in earnest, other varieties of music are merely processed as auditory phenomena. This is not to say that particular *genres* or styles of music are generally processed at a lower level than others – surely, any and all kinds of music have been used as background music in shopping malls, restaurants, and other environmental locales (most often, the style of music played reinforces the theme of the place of business). In effect, this equals the playing field when it comes to discriminating between styles of music that are generally listened to and those which are merely heard.

Human beings have been listening to music for centuries – although the tradition of Western art music has spanned a relatively small portion of the entire span of life on Earth, music has been around in other forms for a much longer part of human history. Yet, the emergence of widespread music *hearing* seems to be a relatively new phenomenon. Perhaps the most obvious reason for this is the technological development of the past century. Today, music is more available than it has ever been, and it seems that everyone – from teenagers to CEOs – has taken advantage of this. One of the first achievements of the internet during the late twentieth century was the facilitation of the spread of music around the world, both through legal and illegal downloading. With the click of a mouse, an individual half-way across the globe could become an owner of a recording artist's music – music he or she otherwise would have never had access to without the internet.

Acoustically, technological developments in sound production and amplification over the past fifty years have also contributed to the ever-growing presence of music in our world. Places of business come pre-installed with speaker systems designed to pump out whatever music will enhance a consumer's experience upon entering. Similarly, the boom in personal, hand-held electronics has given anyone with a desire to have their own daily soundtrack implanted into any and all of their daily activities the ability to do just that for a relatively modest sum of money. This iPod generation goes about life deaf to the auditory world around them – instead of hearing the sounds of traffic on a busy street, passers-by now hear U2 giving a private concert in stereo just for them. This phenomenon has come to the fore in New York City, where a bill was filed by state senator Carl Kruger to ban the use of iPods when crossing city streets, claiming that pedestrians had become too engrossed in their music to safely navigate their way around the city (Beam 2007).

While a ban on portable electronics seems to be an extreme way of addressing this newfound integration of environmental music into our daily experience, the argument behind Senator Kruger's claim – that music distracts us – is compelling nonetheless. During the past two decades, researchers have begun to take interest as to how background music affects our ability to work and play in the multi-sensory experience that has come to characterize the twenty-first century. Unquestionably, the most heralded finding to surface from the earliest waves of interest in this subject was what came to be known as "The Mozart Effect."

As reported by Winner and Hetland (1999), the social and political phenomenon that is known today as "The Mozart Effect" was a premature reaction to a study conducted by University of Wisconsin psychologist Frances Rauscher. Her study was focused on whether or not exposure to music improved spatial task performance. What Rauscher and her colleagues found was that after "listening" to 10 minutes of a Mozart piano sonata, scores on this type of task improved (Rauscher, Shaw & Ky 1993). Among other controversies surrounding the study, it is difficult to prove that participants were actually *listening* to the music, rather than merely being exposed to it.

Winner & Hetland also point out that the improvement in spatial task performance associated with "Mozart Effect" actually only sustained for 10 to 15 minutes; in addition, only 4 out 15 research teams who have replicated the study have been successful in generating a similar positive result. Further, if subjects were assigned to a control activity that provided any sort of mental stimulation, such as reading, they were likely to perform just as well on spatial reasoning tasks as those in the "Mozart" condition. Despite these significant concerns, Rauscher's finding took off – so much so that legislators like Georgia governor Zell Miller proposed a budget allocation allowing for the purchase of a CD of Mozart's music for every newborn baby in the

state of Georgia, with the hope that exposure to this music would improve these children's cognitive abilities (Levitin p.219). Unfortunately for Governor Miller and the state of Georgia, the study upon which this legislation was based has been exposed as one of the most infamously overstated research findings in the past 20 years.

The question of whether or not "music makes you smarter" has been hotly debated since these findings surfaced nearly 15 years ago. Although some research has begun to approach an answer to this fascinating question, much more experimental research will be needed before the scientific community can definitively say whether or not playing Mozart to your infant will make her a brilliant mathematician, novelist, or doctor. When news of the study's findings first broke, many individuals (of whom Georgia's Governor was a prime example) spoke out in support of this alleged effect – people seemed to know and feel intuitively that music does, really make you smarter – they just had not been able to prove it yet. This is significant, in that the attention received by Rauscher and her colleagues (albeit somewhat overblown) was not only a result of their moderately interesting finding; it was also a reflection of an attitude and hope that had lived in the hearts and minds of music-lovers around the globe for centuries.

Although the research design of the study that spawned "The Mozart Effect" did not include a study of how music influences task performance while played during the administration of the task (as *background* music), its findings are relevant to any investigation of how music functions as a part of our daily environment. If music has the ability to prime certain neural circuits such that an individual is better able to perform certain cognitive functions immediately after listening to a piece of music – would one expect a similar result if the music were being played alongside the performance of a similar task, in a sort of active priming process? While this question is compelling, it shares a shortcoming with those of Rauscher's

1993 study – tests of "general cognitive ability," or as they are more commonly known, intelligence tests. Results from these standardized measures can tell us how music may affect performance on these specific tests, but researchers have thus far had great difficulty in generalizing these findings to human experience on a larger scale.

In contrast, an area of research into background music that may hold a more promising immediate future taps an even more fundamental human ability – something that is even more critical to the most basic, as well as the most complex levels of human functioning: memory. Research from an emergent sub-field of psychology has begun to investigate how music, as an established part of our environment, may impact how we remember certain aspects of our everyday lives. Using the artistic medium of the modern-day movie, film psychologists have employed the scientific method in an attempt to achieve a greater understanding of how the relatively new artistic media of television and cinema affect us in such profound ways.

As reported by Annabel Cohen (p.251), the very first psychologist to pay attention to the new movement in film was Hugo Münsterberg from Harvard University. Cohen conveys his enthusiasm for studying the newly emerging art form, as it is captured in an excerpt from one of Münsterberg's last books entitled *The photoplay: A psychological study* (1970; originally published 1916):

> Yes, it is a new art – and this is why it has such fascination for the psychologist who in a world of ready-made arts, each with a history of many centuries, suddenly finds a new form still undeveloped and hardly understood…the psychologist can observe the starting of an entirely new esthetic development, a new form of true beauty in the turmoil of a technical age (Münsterberg 1970, pp.232-3)

Although Münsterberg never saw the day in which technology allowed audio to be integrated as part of the film-watching experience, his assessment of the unique opportunity presented to contemporary psychologists still rings true today.

In a chapter from the book *Music and Emotion* (Juslin & Sloboda 2001), contemporary film music scholar Annabel Cohen outlines the current state of scientific research on music's role in film: "in spite of the integral role of music for film, film music has been largely neglected by the disciplines of both musicology and music psychology until the last decade." Interestingly, one potential reason cited by Cohen for this neglect is the claim that a significant amount of music composed for film has been created "with the understanding that it will not be consciously attended to" (p.250). Cohen's argument is undeniable – indeed, it is rare to even find a single scene, nonetheless an entire film where the film's score is intended to capture the greatest part of a viewer's attention. Perhaps in movies where incongruence between the score and the action on-screen (e.g. *A Clockwork Orange*, *Bonnie & Clyde*) is this closest to the case – even so, these are difficult to find (Boltz et al. 1991).

From the already scant body of empirical research into the phenomenon of music in film, there have been even fewer studies that have focused on how music affects the formation of *memories* of the film-viewing experience. The two main studies whose objective has focused on developing a greater understanding of the relationship between film and TV music and memory have been carried out by Marilyn Boltz, a professor and researcher at Haverford College (PA). As summarized in Cohen's review (p.256), the first of these two looked at differences in memory performance when music was presented prior to (foreshadowing) or alongside (accompanying) a particular film clip. Participants were presented with 20 of these clips from films and TV shows that either resolved happily or sadly, and two musical selections (one happy and one sad) were paired with each film clip. Therefore, in some cases, congruent music foreshadowed or accompanied an outcome, whereas in others, incongruent music preceded or accompanied the

outcome. A control condition was also included, in which participants viewed the film clip without any background music playing.

Upon completion of the presentation of each of the 20 film clips, participants were given memory tests in which they were asked to recall as many details as possible about each of the clips – specifically, information about actions, characters, and outcomes in each. With respect to music that accompanied an outcome, mood congruence (e.g. happy clip – happy music) led to higher recall, while mood-incongruence (e.g. happy clip – sad music) significantly reduced recall essentially to equivalence with the no-music, control condition. On the other hand, foreshadowing music showed an opposite pattern; participants had an easier time remembering those clips in which the outcome violated the expectations established by the music (e.g. sad music foreshadowing a happy ending) than those clips in which the outcome was consistent with the expectations set by the music (e.g. sad music foreshadowing a sad ending) (Cohen p.256; Boltz et al. 1991).

A more recent study from Boltz (2004) extended this investigation of mood congruence in film music; this study asked participants to view a set of film clips that were accompanied by a musical soundtrack that, as in the previous study, was either affectively congruent or incongruent with the mood of the video. However, this study departed from the first in its instruction to participants – they were told to attend to either the action on-screen, the musical accompaniment, or both together. Participants were then assessed for visual memory through a guided free recall task, among other measures of musical memory and video-music pair discrimination. With respect to film recall, two primary results were found: first, films that were accompanied by music with similar affect (mood-congruent) were remembered better than those with different affects (mood-incongruent), and second, recall was significantly enhanced when participants

were instructed to attend to both the music and film together, rather than one or the other separately (Boltz 2004).

These results coincide with the previous findings of an enhancement in memory for mood-congruent music-film pairs, when music is presented *alongside* a film clip. Further, the latter study indicates that when participants are instructed to devote their attention to only one portion of a film experience (e.g. the music or the action), they have more difficulty in recalling the clips' sequences of events, main characters, and final outcomes. This is surprising – one would expect that those participants instructed to ignore the music in favor of the on-screen action would be able to recall the latter with much more ease than those who had been instructed to focus on both, and certainly with greater ease than those who had been instructed to only focus on the music. The finding suggests a sort of "incidental learning" for this particular group of participants, as attending to the clip's music alone did not inhibit them from retaining the majority of the main components of the story and action presented on-screen (Boltz 2004).

Taken together, these two studies have begun to establish a framework for understanding the complex interplay between music in film and memory. Also, the results of Boltz's investigations fit nicely into the "Congruence-Associationist Model" of how film music functions, as proposed by Marshall and Cohen (1988). Cohen writes that the model explains the functions of film music through congruence or association, as they "represent two primary ways in which the brain operates: through innate grouping principles and by learned connections, respectively" (Cohen 2001, pp.258-259). In expressing the foundations of this model, Cohen describes eight distinct functions of music in the context of film:

> First, music masks extraneous noises. Second, it provides continuity between shots. Third…it directs attention to important features of the screen through…associationist congruence. Fourth…it induces mood. Fifth, it communicates meaning and furthers the narrative, especially in ambiguous situations…Sixth, through association in memory,

> music becomes integrated with the film…Seventh, music heightens the sense of reality of or absorption in film, perhaps by augmenting arousal…Finally, music as an art form adds to the aesthetic effect of the film. (Cohen 2001, p.258)

Without question, each of these functions appears to be a reasonable way in which music enhances the experience of film, and Boltz's findings coincide with the theoretical framework laid out by Cohen. Through these first empirical findings, film psychologists have begun to comprehend the innate ability of music to create drama where there would otherwise be none.

The research presented in this review represents a small step toward developing an understanding of how music influences our memory for various events throughout our lifetime. However, within the field of psychology, these few studies can be supplemented tremendously by broadening the scope of this research to another area. In any discussion of the multifaceted effects of music on human beings, emotion must be considered as a central component to how it impacts our lives. As reviewed by Reisberg and Heuer (2004), human beings are more likely to remember emotional events than non-emotional ones. Further, Kensinger (2008, in press) writes that interest in developing a greater understanding of how emotion provides this memory enhancement has grown significantly during the past two decades.

It seems obvious that in an investigation of how music may shape our memories for various encounters and events that characterize our everyday experience, emotion is key. Findings from the growing field of emotional memory research can undoubtedly inform the many questions that remain about how music in film – as well as music in our environment – may affect the formation and storage of our memories. Although both fields of film psychology and emotional memory research are sub-fields of psychology, taking an interdisciplinary approach to this phenomenon may be prove rewarding. Though these two areas are seemingly quite disparate when taken at face value, I feel that they tap the same fundamental human

capacity for emotion. Many would argue that music that lacks emotion ceases to be music altogether. This view is reflective of just how intrinsic emotion is to any study of music – here, emotional memory may provide insight into the questions that have remained unanswered since the inception of film in the early twentieth century, as well as the questions that characterize our musical voracity in the twenty-first century.

While the findings of Marilyn Boltz and colleagues (1991; 2004) have been the first to take a scientific look at how music might affect our memory for filmed, emotional events, there is one major shortcoming that underscores the external validity of both of her designs. In both studies previously discussed, musical excerpts were taken from each of the film or TV clips used in the investigation, and were determined to reflect either positive or negative affect (e.g. happy or sad). Once this determination was made, the musical pieces were assigned to a different film clip based on the clip's affective value, such that each film clip could be viewed under one of three conditions: 1) mood congruence (e.g. happy clip – happy music), 2) mood incongruence (e.g. happy clip – sad music), or 3) a control condition, where no music was played.

The majority of Boltz's results hinge upon this manipulation of mood congruence – when accompanying a film clip, congruent pairs result in better memory performance; when foreshadowing a film clip, the opposite pattern is true. The only result that does not rely on the validity of this manipulation was the finding relating memory performance to attentional distribution, where those who focused on the film-music pair *together* displayed a memory enhancement in comparison to those who either focused solely on the music or solely on the clip. For those that do rely on the manipulation of congruence, the question of external validity must be asked. In each presented film clip, its original music had been removed by the researcher, and

new music had been transplanted into the scene, based only on its affective valence (positivity or negativity).

Surely, Bernard Herrmann and Michel Rubini – two of the composers whose music from *Alfred Hitchcock Presents* and *The Hitchhiker* was used in Boltz's design – would object to this type of shallow characterization of their work (Rubini; DeMary 1997). Much more goes into film composition than simply an assessment of positive or negative affect; rather, music and film are intricately interwoven such that music enhances the emotional content of what is expressed on-screen, without becoming so intrusive as to detract from the reality absorption of the film's action. From this point of view, one could argue that the congruent music-film pairs were incongruent in regard to the differential timing of musical and cinematic events. Likewise, this reasoning would further suggest that the incongruent music-film pairs would, in actuality, reflect a dual-incongruence – where both valence and the transplanted scoring would be incongruent with a scene. This artificial insertion carried out by Boltz and colleagues seems to undermine the attention to cinematic detail that is of foremost concern in composing for film. In a recent interview, the late, great film composer Elmer Bernstein remarked "If you hire a composer who's worth anything, the best thing he's going to do is contribute something that the director couldn't even think of" (Russell & Young, p.40).

With this in mind, it would seem difficult to generalize the findings of these two studies to a more naturalistic film setting. Categorizing pieces of music that had been composed with one film and one film only in mind should be a major concern in assessing the external validity of these findings. Although the pieces of music were characterized according to their musical properties, binning them together into two groups hardly begins to do justice to the lengthy compositional process of the individuals who created them. Aside from these artistic concerns,

from a scientific point of view, this musical transplantation poses a threat to the ability of the findings to generalize to an *actual* film experience. Most often in modern film and TV, the music one hears has been written not only with valence in mind, but instead, has been scored by a master composer to fit perfectly with the action on-screen, as well as to enhance the emotional content that is being conveyed.

The study presented here intends to study the phenomenon of background music in a film-watching experience from a naturalistic point of view; that is, by presenting a film with its own, originally composed soundtrack. Instead of randomly assigning music to film based on the superficial criterion of valence, the current investigation hopes to employ a more realistic film-viewing experience in an attempt to look at remembering from an integrated perspective of film psychology and recent emotional memory research. As of the spring of 2008, no previous studies have been found by the researcher to employ this type of naturalistic paradigm in a study of film music's effect on the later remembering of an emotional scene.

A number of methodological concerns arise in any study of memory – the most important of these being participants' prior familiarity with stimuli presented to them in the laboratory. Familiarity is the most obvious potential confound to a study that is interested in how well a scene will be remembered, and it is critical to ensure that every participant is on the same level prior to entering the laboratory. In order to achieve this, the current design employs a film that was first released in 1938 – Sergei Eisenstein's epic tale *Alexander Nevsky*. Using this particular film has also allowed me the opportunity to utilize one of the greatest film scores of the past century, written by Sergei Prokofiev. Recent developments in recording technology have provided me the additional ability of manipulating the musical content that accompanies the film clip – thereby allowing maximal researcher control over what participants will see and hear.

The scene from *Nevsky* that I have chosen for the current study represents the film's most intense emotional climax; in "The Battle on the Ice," the under-manned, under-equipped Russian army prepares to defend their homeland against their ruthless oppressors – the Germans. The scene opens on a cold, cloudy day on a stark landscape, with slow, deliberate music that reflects the calm before the battle, as well as the underlying tension that is about to build. As the scene continues, the music imitates the action on-screen: as soon as the Germans begin their charge, Prokofiev's strings begin an incessant *ostinato*, or pattern of repeating eighth notes to signify their encroachment on the waiting Russian soldiers. As the Germans get closer and closer, Eisenstein's shots of the Russian soldiers faces increases the tension of the scene tremendously, and the music follows suit.

In 1996, the soundtrack to Eisenstein's Russian epic masterpiece was re-recorded by the St. Petersburg Philharmonic Orchestra. This contemporary re-recording of the film's original soundtrack has presented me with a truly unique opportunity: to employ two versions of the film's original score, along with a muted track, to investigate how quality of music may impact later remembering within the context of cinema. *Alexander Nevsky* is truly unique in its fit with the current research design: it is likely to be highly unfamiliar with young adults, its music has been recorded twice (with very different outcomes) and the particular scene chosen for this study has minimal spoken text – thereby maximizing the interplay between the film's music and on-screen action.

Aside from the use of a naturalistic film setting in which the presented music is the music that was composed specifically for the presented film, the current study also departs from previous research in assessing memory performance. Boltz (2004) and colleagues (1991) measured participants' memory for the films that they viewed primarily through free recall

techniques and limited cued recall using the melodies from some of the previously seen clips. Ultimately, this leaves the decision of determining what is to be reported as remembered up to each participant in his or her free recall narrative, but they were instructed mostly to discuss the objective details of the "episodes' actions, characters and final outcomes" (Boltz 1991). In the current design I hope that a more thorough look at several different types of memory may allow researchers to develop a better understanding of how film music influences the development of emotional memories.

Due to the novelty of my current design, it is difficult to speculate as to how the interaction of a film's original music and on-screen action may reflect differential memory performance across a variety of measures assessing participant recall. Aside from these memory tasks, the primary manipulation of the study – the presence and quality of music alongside the film – is intended to reflect an increase in arousal across the three conditions: A – No music presented (low arousal), B – Original recording of film's soundtrack (moderate arousal), and C – Re-mastered recording of film's soundtrack (high arousal). I hope this manipulation will be a point of departure for the study; post-viewing levels of arousal may tell us something about the emotional effect of music, upon which memory performance may hinge.

Upon completion of viewing the selected segment from *Alexander Nevsky*, participants will be assessed for their arousal, their own, *subjective* memory for the clip, their memory for *emotion* conveyed in the clip, their memory for *objective*, visual details from the clip, and their memory for a more large-scale measure of *temporal* memory. Kensinger and colleagues (2007) have demonstrated the existence of memory trade-offs in the remembering of emotional scenes; specifically, high emotionality tends to promote memory for "gist" memory, while inhibiting remembering of visual details in some encoding tasks. Certainly, our attentional resources are

limited, and we cannot attend to all aspects of the stimuli in our environment. With respect to the current design, this may very well be the case; as Cohen expresses in her third function of film music, one of its roles is to direct attention toward important features of the screen – I regard these as salient, emotional features that aid in both *understanding* and *remembering* the story presented on-screen.

2: Method

2.1: Participants

Undergraduate students enrolled at Boston College were recruited through flyers and sign-up sheets, as well as Sona-Systems, the University's online Experiment Management System. Fifty-six students participated in one of three "music" conditions – A, B, or C; these consisted of no music, the original recording of the film's soundtrack, and a high-quality, re-mastered recording of the film's soundtrack, respectively. The nature of the current design allowed for multiple participants to be tested in a single session; therefore, up to four participants were tested in each experimental trial. Prior to completing the experiment, all participants were informed that they would be compensated for their time with either $10 in cash or one "research credit" toward their Departmental requirement.

Participants were distributed evenly between groups across age (mean age for all groups = 19) and scholastic aptitude (mean GPA for all groups = 3.4). Although the total sample reflected a greater number of female participants than male, within-group proportions were virtually equal across all three groups (A: 22 total, 9 male; B: 17 total, 5 male; C: 17 total, 7 male). In one case, a portion of an individual's responses were not completed due to participant omission; the remaining responses from this participant were included in the final analyses.

2.2: Apparatus

All participants were tested in McGuinn Hall of Boston College's Chestnut Hill Campus. The DVDs of the film clips themselves were played on an *Apple MacBook* laptop computer, and were also enlarged and projected using an *InFocus* LCD projector. For groups B and C (those conditions involving musical production), *Bose Companion* stereo speakers were used to amplify the soundtracks accompanying the film clip. In order to assure consistency across the two music conditions, an external decibel reader was used to normalize the overall sound output of each condition (approximately 70-72 dB). In order to eliminate the possible confound of varying intensities of sound, speaker volume levels were adjusted to ensure that both music conditions (B & C) were equal in this regard.

Due to the particular musical manipulation of this design, new DVDs were created in order to simulate a consistently authentic film experience across all three conditions. This was accomplished using the *Apple iMovie* and *iDVD* multimedia software, where an original DVD of Sergei Eisenstein's *Alexander Nevsky* (1938) was used to accommodate the two new musical backgrounds (A: Silence, C: Re-Mastered). For condition A, this required the elimination of the soundtrack altogether; for condition C, this required the replacement of the film's original soundtrack with a 1996 re-recording of the film's original score, composed by Sergei Prokofiev (condition B required no such musical manipulation, and was presented as-is).

Although participants in each testing session were randomly assigned to one of the three music conditions prior to its beginning, this did not influence which physical materials were used in any given testing session; that is, speakers were present in the testing room for all trials, regardless of which condition was being executed at that time. The film clip chosen for this study was approximately six minutes in length, and all external lighting in the testing room was

eliminated while the clip was presented. Therefore, the only illumination in the room during the film screening itself was emitted by the black-and-white DVD itself. However, use of a projector enlarged the original image considerably, and greatly enhanced viewing ability.

2.3: Materials

Measures of arousal, subjective memory, emotional memory, objective memory, and temporal memory were included in a post-viewing questionnaire administered to all participants. The aim of these cognitive and affective tasks was to assess how students' memory for the film clip may have been shaped by the presence of music (or lack thereof). Finally, participants were asked to complete a brief demographic sheet to ensure between-group equality on intact characteristics such as age, academic achievement and other factors.

Arousal. The first task administered to participants immediately after viewing the film clip was Craig Anderson's Perceived Arousal Scale (Anderson, Deuser, & DeNeve 1995). The version of the scale used in the current study includes 24 emotion words, such as active, lively, vigorous, dull, fatigued, depressed, and worn-out. Participants were asked to rate how much they felt each of these emotion words at the present moment, on a scale of 1 to 5 (where 1 = very slightly or not at all and 5 = extremely). Since the words used in this measure were polarized (indicating either high or low arousal), some of the items were reverse-scored (see Appendix A). Each participant achieved a total score out of a maximum of 120, and this was then converted to a percentage (x/120).

Subjective Memory. The second task presented to participants was a modified version of the Memory Characteristics Questionnaire (Johnson, Foley, Suengas & Raye 1988), adapted to fit a film viewing experience. However, these alterations were relatively minor, such as changing the word "event" to "film" within the context of particular questions. In line with the

aim of the original incarnation of the MCQ, our version of this task asked participants to assess their own, *personal* memory for the film clip using a linear scale from 1 to 7, based on the specific criteria for each question. Examples of those assessments included in our analyses were: "My memory for the film: involves visual detail, 1 = little or none; 7 = a lot," as well as "Do you have any doubts about the accuracy of your memory for the film: 1 = a great deal of doubt; 7 = no doubt whatsoever." Some of the questions included in the original version of the MCQ did not relate to the research questions of the current design, and these were omitted from our analyses (see Appendix B). Finally, participants' responses were converted to a percentage score based on the highest possible MCQ score for the sake of inter-measure comparison.

Emotional Memory. In assessing participants' memory for emotion, the novelty of the current design demanded the development of a new measure to accommodate the needs of our investigation. Forty-one emotion words were listed alphabetically, and participants were asked to indicate which of these had been expressed in the film clip. Words in this list included affection, fear, hate, panic, surprise, and terror, among others (see Appendix C). Additionally, I felt it was important to distinguish between emotions that the participant recalled *experiencing* within him- or her-self during the clip and those recalled that had been *conveyed* on-screen. In order to assess the latter, when reporting that an emotion had been expressed, participants were also asked to describe when or where in the clip each of these emotions were conveyed on-screen, thereby enabling the researchers to validate participants' initial responses.

In three cases, participants reported emotions that they had experienced (but one not conveyed on-screen), and their responses from this measure were omitted from the final analyses. Of the 41 emotion words presented to participants, 19 of these were collectively determined by a group of coders to be "hits." Likewise, the remaining 22 were determined to be

"false alarms," allowing for the computation of a "corrected" recognition score. In calculating this statistic, the percentage of false alarms reported by each participant (x/22) was subtracted from the percentage of hits (x/19) achieved.

Objective Memory. A new measure was demanded once more for an evaluation of participants' memory for objective aspects of the film clip – specifically, visual and spatial components. Participants were asked 30 questions relating to various aspects of the film's on-screen action – from basic visual memory characteristics, such as "What was the priest holding when he delivered his blessing?" to more discriminatory questions such as "The shields of the _____ side were circular" while "The shields of the _____ side were rectangular" (see Appendix D). Participants were awarded one point for each correctly answered question, and this was converted into a percentage, out of a total possible score of 30.

Temporal Memory. Although this measure may be viewed as a sub-measure of a broader objective memory score, there are some defining characteristics that warrant consideration of this particular task on its own. Participants were asked to arrange eight of the film's events in chronological order, from 1-8 (1 = the first, 8 = the last). Each correctly labeled event was awarded one point, allowing for a maximum score of 8 (see Appendix E). As with all other measures, these raw scores were converted into percentages with the objective of improving inter-measure consistency and meaningfulness of later comparisons. This particular measure should be considered distinct from the aforementioned objective memory task since it assesses participants' "gist" memory for the film. While the objective memory questionnaire taps a participant's ability to report specific visual details of the film, this task requires a much broader understanding of, and memory for the film unit as a whole, and for this reason, it will be considered separately in this paper.

Demographics. The final measure that participants were asked to complete consisted of a brief series of questions regarding their previous familiarity with the content of the study, as well as their overall academic background. Students were asked whether or not they had heard any of the music presented to them during the experiment, as well as whether or not they had ever viewed any of the video presented to them prior to coming in for the testing session. These questions were included primarily to eliminate any potential confounds relating to prior familiarity or exposure that may impact a participant's memory performance. Additionally, each participant was asked whether or not he or she consciously tried to remember any aspects of the film during the testing session. In addition to these questions, students were also asked their age, sex, major areas of study, and approximate GPA (see Appendix F).

2.4: Procedure

Prior to the arrival of participants in the laboratory, each session was randomly assigned to one of three music conditions (A, B or C). Those in group A experienced the clip from *Alexander Nevsky* in silence; those in group B experienced the same clip with the film's originally recorded soundtrack (low arousal); those in group C experienced the clip with a re-mastered, re-recorded soundtrack of the film's original score (high arousal). Upon entering the lab, students were asked to seat themselves in a conference room facing a large white board, onto which the film clip was projected. Prior to the beginning of each testing session, participants were administered two informed consent documents, both of which were signed and one of which was retained by the researcher.

Once informed consent was obtained from each participant (up to four in any given session), the researcher gave a brief overview of what the testing session would entail. Because the film clip was taken from the middle portion of a film, participants were given a paragraph of

background information, setting the context for the film clip that they were about to view. After reading this over, the researcher dimmed the lights in the testing room, and played the DVD corresponding to which particular condition the participants had been randomly assigned to. When the film clip was completed (the clip was approximately 6 minutes long), each participant was given a packet containing the aforementioned questionnaire materials. Participants were encouraged to take as much time as they needed to complete the six measures, and were also encouraged to ask the researcher for clarification on any of these, if needed. These tasks were intentionally not counterbalanced, due to unwanted priming effects that could result from this type of variable ordering.

Upon completion of all six measures contained within the questionnaire, the researcher collected the packet from the participant, and he or she was notified that this would conclude the testing session. Students were then thanked, debriefed, and received either $10 in cash or 1 research credit in compensation for their time. Each session lasted no more than one hour, and all were conducted by the primary investigator, in McGuinn Hall, room 504C of the Cognitive and Affective Neuroscience Laboratory at Boston College.

3: Results

All data were analyzed by univariate and repeated measures ANOVA with music condition (A, B, or C) as the independent variable, and each measure (arousal, subjective memory, emotional memory, objective memory, and temporal memory) as the dependent variables. One exception to this was made when a notable trend was found across all three conditions between participant scores on measures of subjective and objective memory; these data were subsequently analyzed using statistical tests of bivariate correlation. All statistical

tests were computed with the aid of the Statistical Package for the Social Sciences (SPSS). Between-group comparisons for each individual measure are reported below, followed by interactions involving multiple measures.

3.1 Preliminary Analyses

Arousal. Descriptive statistics for the arousal task included in this study can be found in Figure 1 and Table 1 of Appendix G. No significant differences were found between the three groups on this measure of arousal ($F_{(2,53)} = .876$, $p = .423$). However, there was a numerical trend for the perceived arousal of the three groups to track alongside the increasing emotionality of the three musical tracks. Arousal ratings were lowest in condition A (no music), followed by condition B (low-quality music), and C (high-quality music).

Subjective Memory. Descriptive statistics for the subjective memory portion of the study can be found in Figure 2 and Table 2 of Appendix G. Differences between the three groups on subjective memory were not found to be statistically significant ($F_{(2,52)} = .898$, $p = .413$). In assessing their own, subjective memory for the presented film clip, participants in condition B (low-quality music) reported the highest mean memory score among the three groups. Those in condition A (no music) scored second-highest on this task, and participants in group C reported the lowest ratings of subjective memory for the film. This finding represents the only instance in which group B is at an extreme; that is, for all other measures, group B's performance was in between that of groups A and C. Despite the non-significant finding for this measure, the uniqueness of the result (within the context of the other four) is interesting nonetheless.

Emotional Memory. Descriptive statistics for the emotional memory component of the study can be found in Table 3 and Figure 3 of Appendix G. Although the differences found between groups A, B, and C for this measure did not reach significance ($F_{(2,50)} = .691$, $p = .506$),

a clear pattern emerged: Participants in group A scored the highest (on average), followed by groups B and C, respectively. Participants were scored on the percentage of correct emotions identified (hits) in the film from a given list. By subtracting the percentage of emotions *incorrectly* identified (false alarms) from this score, an assessment of memory for emotions that corrected for response bias was achieved. Therefore, as the overall quality of music increased (A→B→C), participants had increasing levels of difficulty in accurately identifying emotions presented in the film.

Objective Memory. Descriptive statistics for the objective memory portion of the study can be found in Table 4 and Figure 4 of Appendix G. As with the previous measures, between-group differences in objective memory were not statistically significant ($F(2,53) = .534$, $p = .589$), but were revealing nonetheless. In recalling specific visual and spatial aspects of the film's content, participants showed a similar pattern to that of the emotional memory task: the mean score for group A was highest, followed by B and C, respectively. Their alignment with the results of the emotional memory score implies that the presence of music may well have a two-pronged, inhibitory effect on participants' recollection of specific visual details, as well as emotions conveyed on-screen.

Temporal Memory. Descriptive statistics for the temporal memory component of the study can be found in Table 5 and Figure 5 of Appendix G. While the inter-group differences for temporal memory were ultimately not found to reflect statistical significance ($F_{(2,53)} = 2.302$, $p = .110$), results for this task were, by far, the closest to reaching significance of all five of the comparisons. For the final task of the study, results showed a pattern across conditions similar to that of participants' arousal ratings. As the quality of the musical accompaniment to the presented film *increased* (A→B→C), participants displayed a corresponding benefit in their

ability to place a series of the film's major events in the correct chronological order. Further, the statistical alignment of arousal ratings and temporal memory suggests that these two seemingly disparate measures may reflect a common underlying mechanism.

3.2 Primary Analyses

It is important to recognize that although none of the preliminary analyses of variance yielded significant differences between the three groups, consistent patterns of variation were observed – particularly between groups A and C. In several cases, if data from these two groups were to be considered alone, similar statistical tests to those employed above would reflect much more pronounced statistical distinctions. This is especially true for emotional memory ($F_{(1,35)}$ = 1.370, p = .250), arousal ($F_{(1,37)}$ = 1.482, p = .231) and temporal memory ($F_{(1,37)}$ = 4.228, p < .047), where significance would be reached if analyses included only groups A and C.

Beyond these single-measure analyses of cross-group differences lay much more compelling and meaningful results; I now turn my attention to interactions that have surfaced from my primary analyses. First, a nearly significant interaction was found between measures of objective memory and temporal memory ($F_{(2,53)}$ = 3.002, p = .058). Here, results show that while increasing musical quality is reflected in an enhancement for participants' ability to correctly order a series of events that take place on-screen, musical quality is *inversely* related to participants' ability to cite visual and spatial details about the film (shown graphically in Figure 1 of Appendix H). The presence of this interaction seems to suggest two diverging pathways for the resultant effects of these musical accompaniments to the presented film clip.

Second, a significant interaction was found between measures of emotional memory and temporal memory ($F_{(2,50)}$ = 4.222, p < .020). Here, as the level of musical quality increased, participants' mean scores for recalling emotions expressed in the film clip suffered. Meanwhile,

temporal memory demonstrated a corresponding enhancement with the elevation in accompanying musical quality (shown graphically in Figure 2 of Appendix H). Third, a notable, yet non-significant interaction was found between measures of arousal and emotional memory ($F_{(2,50)} = 2.106$, $p = .132$). This result reflected an inverse relation between participants' reported level of arousal after viewing the film clip and their ability to correctly identify emotions conveyed on-screen (shown graphically in Figure 3 of Appendix H). Interestingly, the more aroused a participant felt after the conclusion of the clip, the more difficulty he or she had in correctly recognizing which emotions had been expressed by the characters in the film, and which had not.

Finally, I observed some striking similarities in the mean response rates for two of the five measures: subjective memory and objective memory. While one represents an entirely subjective, participant-generated score of how well an individual's memory for the film is, the other measure could be seen as the one single task that the experimenter has the most control over (and, subsequently, that which the participant has the least). Remarkably, a highly significant correlation ($r_{(53)} = .378$, $p < .004$, two-tailed) was found between participants' scores on the objective memory questionnaire and on the modified Memory Characteristics Questionnaire, which taps their own, subjective feeling of their memory. While this finding as a whole is interesting, it is even more compelling to further examine this result in greater detail.

When the component correlations are broken down by group, by far, the greatest contributor to this highly significant overall correlation is group C (shown graphically in Figure 4 of Appendix H), whose correlation ($r_{(15)} = .657$, $p < .004$) is more than double that of group B ($r_{(15)} = .329$, $p = .197$), and more than six times that of group A ($r_{(19)} = .106$, $p = .647$). Fisher's z-values were used to determine whether these correlations differed statistically from one

another. Results from these analyses showed that although Group A and B did not differ significantly ($z_{\text{Fisher's}} = 1.56$, $p = .120$, two-tailed), the difference between Groups A and C did, in fact reach statistical significance ($z_{\text{Fisher's}} = 1.91$, $p = .056$, two-tailed). These correlations reveal that those in the high-quality music group demonstrate an uncanny ability to accurately assess and report the quality of their memory for the film, especially in comparison to those in the other two groups.

IV. Discussion

This study examined the effects of background music on later remembering of a presented film clip. Here, film was designed to serve as a naturalistic setting in which to observe the interaction between music and the events that we experience during our everyday lives. Several independent measures of participants' memory for the presented film clip were used, with the objective of developing a more complete picture of how music becomes integrated with on-screen action, and ultimately impacts our ability to recall certain aspects of filmed events. Among these were measures of arousal, personal, subjective memory, memory for objective, visual details, memory for emotions, and temporal memory.

As hypothesized, the manipulation of the film's musical soundtrack resulted in a positive relationship between musical quality and arousal. Participants who viewed the film in silence (Group A) reported the lowest levels of perceived arousal; those who viewed the film with the original, low-quality recording of its soundtrack (Group B) reported slightly higher levels of arousal, and participants who viewed the film along with a re-mastered recording of the film's soundtrack (Group C) reported the highest levels of arousal. On a large scale, this may be interpreted as the overall emotional effect that the film had on its viewers: depending on which music condition a participant had been assigned to, an increase in one's arousal level would be

related to the quality of background music that had been presented, with the silence condition serving as a baseline.

Participants' performance on measures of objective memory and emotional memory showed the opposite pattern: as the quality of the musical soundtrack improved (A→B→C), performance on these tasks *decreased*. In contrast, performance on the measure of temporal memory *increased* as the quality of music improved. This seems to suggest that there is something fundamentally different about how these qualities of remembering (objective memory and emotional memory, on one hand, and temporal memory on the other) are affected when music is presented along with a scene. Moreover, the measure of temporal memory included in this study may be interpreted as an index of gist memory – or memory for the primary, most essential components of the scene. In ordering the major events of the film's action, participants were forced to integrate their entire memory for the clip into a coherent whole. Temporal memory, in this way, may be regarded as distinct from the other measures, in that it assesses a much larger-scale form of memory than any others, and requires a different, more fully developed memory for the clip than the other measures demand.

The second main finding of this study was a striking correlation between participants' subjective assessments of their memory for the film and their actual, observed memory performance on an objective memory task. Although the overall relationship was strong enough to reflect statistical significance, by far, the greatest within-group correlation of the three was that of participants in Group C, or the high quality music group. Participants in this group displayed an exceptional ability to predict their own performance on a later measure of their memory for objective, visual details presented in the film.

Interestingly, Kensinger and Schacter (2006) found that memory for negative, arousing information tends to be remembered with more contextual detail than neutral information, thereby limiting its proneness to distortion. Their finding suggests that this type of negative arousal (induced most in Group C) "can enhance not only the subjective vividness of a memory, but also a memory's accuracy." Though the stimuli used by Kensinger and Schacter were words, rather than a cinematic scene, the findings may contribute to formulating an explanation of the astounding accuracy in subjective assessment of memory as evidenced by those in the high-quality music group of the current study.

In her 1991 study of background music and memory, Boltz and colleagues found that when mood-congruent music accompanied a filmed event, participants' memory for that event was enhanced, relative to a no-music condition. Here, memory was assessed primarily through free recall; of the measures used in the *current* investigation, her assessment most closely resembled my measure of objective memory. Additionally, Boltz employed music from modern 1980's TV and film, which therefore would be closest in quality to the 1996 re-mastered recording of the soundtrack to *Alexander Nevsky* (Group C). Remarkably, the findings of the current investigation show the exact opposite pattern of that found in Boltz's study. In the design by Boltz, those who were exposed to mood-congruent music displayed better memory for the film's objective content with respect to a no-music baseline; in the current study, participants exposed to the mood-congruent music written specifically for *Alexander Nevsky* displayed much *worse* memory for the objective, visual details of the film than those in the no music condition (Group A).

What is even more striking about this finding is that those in the baseline, no-music condition of the current study (Group A) not only outperformed one with-music group, but

outperformed two with-music groups (Groups B and C) on a measure of their ability to recall specific visual details about the action on-screen. Although the inter-group differences across this particular measure were not found to be statistically significant, the trend that has emerged from these data is of particular interest in light of the previous finding of Boltz and colleagues (1991).

Of Cohen's (1999) eight theoretical functions of film music, five are especially relevant to a discussion of these conflicting findings:

> (film music) directs attention to important features of the screen through structural or associationist congruence…it induces mood…it communicates meaning…music heightens the sense of reality…perhaps by augmenting arousal, and increas(es) attention to the entire film context and inattention to everything else. (Cohen 2001, p.258)

The results of the current study are especially aligned with the physiological arguments made by Cohen – specifically, that film music increases arousal, and may also induce mood. She also writes that music guides attention toward "important features of the screen," referring to visual patterns that are mimicked by patterns in auditory stimuli presented on-screen (Cohen 1999). This is precisely the argument that has been made in this paper for a new approach aimed at moving beyond the cursory classification system of mood-congruence used in the studies by Boltz and colleagues (1991, 2004), in favor of a model that recognizes the deeper, more intricate aspects of composition and orchestration that are intentionally aligned with visual events presented on-screen. If this definition is to be applied to the current study, the finding of poorer visual memory scores for those in the high-quality music group would conflict with Cohen's prediction – that for soundtracks in which musical patterns imitate visual patterns, viewers should be more likely to pay attention to visual details.

In contrast, Boltz's finding would appear to support Cohen's prediction – except for the fact that Boltz's musical excerpts did not share any pattern-related congruence with the visual

scenes with which they were randomly paired. Therefore, although Cohen's theory of special attention being paid to visual elements that are congruent with musical patterns appears to be logical, all of the research presented here (both from Boltz, as well as from the current study) seems to suggest otherwise. Perhaps the results of the current design could help to qualify Cohen's claim – namely, the finding that certain visual features of a film (e.g. gist-related temporal memory) may be remembered better than other visual features (detail-driven objective memory) when film's music and on-screen action both demonstrate valence- and pattern-related congruence.

Citing recent research in emotional memory, Kensinger, Garoff-Eaton and Schacter (2007) reported that when an individual is presented with an emotional stimulus, such that not all of the information presented can be processed simultaneously, two kinds of information have been discussed as possessing an advantage for later remembering: central, emotional information over "peripheral nonemotional elements of scenes," as well as gist information over visual details. While their findings confirmed the former of these claims, the gist trade-off only occurred in conjunction with the assessment of the nonemotional background of a scene (Kensinger et al. 2007). The current study shows a similar pattern of remembering, in which participants' gist recall (as measured through temporal memory) follows a pattern opposite that of their memory for visual details. Although Kensinger and colleagues did not find a gist trade-off with respect to a negative, visually arousing object itself, they did find a gist trade-off in which "elements peripheral to the negative visually arousing object in a scene" were at a detriment, and "the visually arousing objects themselves typically appear to be remembered with more gist, and also with more visual detail, than do neutral objects" (Kensinger et al. 2007).

In the current design, the objective memory measure largely assessed participants' memory for those very peripheral elements outlined by Kensinger and colleagues (2007). Likewise, the visually arousing object that was the point of focus in her study may translate to the integrated film-music storyline presented on-screen. In other words, the true focal point of *Alexander Nevsky* may not be a single person, weapon, or other object, but rather, may be considered the scene's pervading narrative – something that the music has been integrated into and is ultimately an inextricable part of. Within this framework, the finding of the current study would align with the findings of Kensinger and colleagues, where a true trade-off characterizes the inverse relationship between quality of music (and arousal) and differential patterns of remembering, such that for highly emotional scenes (e.g. Group C), gist-related aspects are remembered at the expense of peripheral items; conversely, in scenes characterized by lower relative emotionality (and arousal), non-emotional, peripheral aspects of the film (e.g. visual details) are remembered at the expense of gist-related information.

Although I am optimistic that the current study will advance the current body of research bridging the gap between film psychology and the development of emotional memories, several limitations have plagued the findings presented here. First among these is sample size; in addition to the sample size of this study being relatively small (N = 56), the three groups were not equal in their numbers. Within these sampling concerns, all three groups were weighted with an unequal proportion of male participants to females. However, similar distributions of males and females in each of the three groups have made this concern somewhat more palatable.

Another limitation imposed on this study was the measure of emotional memory conceived especially for this design. Scoring of this measure was done by developing a coding scheme using three independent coders; these coders independently determined which emotions

should be scored as correct or incorrect, then discussed any disagreements about which emotions they thought had been conveyed on-screen during the clip. Although this process was relatively straightforward for some words, other words were ultimately decided upon through judgment calls, rendering the measure susceptible to the constant criticism of subjectivity. This concern is elevated by the curious current finding with respect to emotional memory – although the inter-group differences were modest, a pattern emerged in which increasing emotionality of the film clip predicted decreases in performance on correctly identifying emotions conveyed on-screen. As has been discussed at length in this section, emotional memory research has shown the opposite trend – where emotions are often remembered quite well, usually at the expense of more objective, peripheral items (Kensinger et al. 2007).

Another concern surrounding the current study involved participant intent: in each group (A, B & C), approximately 20 percent of participants reported that they had been consciously trying to remember the film clip during its presentation, despite not receiving any sort of instruction to do so. While the portions of all groups who had made this statement are nearly equal, concerns still arise as to differential devotion of attention as a potential confound to these results. For instance, those who reported consciously trying to remember the film clip may have been paying especially close attention to the visual details of the clip; conversely, those who did not report such behavior may have simply been distributing their attention normally to all stimuli presented during the film watching experience.

Despite these limitations and potential confounds, the current study represents a modest step toward the promotion of interdisciplinary collaboration within field of psychology. The current investigation is one that holds the artistic domains of music and film at its core, while looking to recent developments in an emerging field of emotional memory research for deeper

explanations, and the possibility of developing a mutually-informing relationship between the two areas. It should also be said that this body of research into environmental music is still in its earliest phases, and continued research is needed in order to seek out more definitive answers for the questions that exist today, as well as those that have yet to be conceived of.

Specifically in regard to the current paradigm, I intend to further investigate the application of mood congruence to studying this phenomenon – is valence sufficient to characterize a piece of music, or would more research into effects of music on memory suggest otherwise? This is but one potential question that may be posed in the near future, and I sincerely hope that many more will follow. As long as human beings have a thirst for knowledge, a passion for discovery and a love for music, this collaboration between artistic and psychological research will likely thrive for years to come.

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Appendix A

Perceived Arousal Scale

Different people react very differently to the same situations. Indicate to what extent you feel this way right now, that is, at the present moment. Use the following 5-point rating scale. Write the number corresponding to your rating on the blank line next to each word.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

____active	____alert	____aroused	____depressed
____drowsy	____dull	____energetic	____excited
____exhausted	____fatigued	____forceful	____inactive
____lively	____powerful	____quiet	____sharp
____sleepy	____slow	____sluggish	____tired
____vigorous	____weak	____weary	____worn-out

Appendix B

*Note: Only the following questions were included in computing participants' final scores: #1,2,3,4,8,10,11,12,13,14,19,23,25,28

Modified Memory Characteristics Questionnaire

My memory for the film:

1. Is 1 = dim; 7 = sharp/clear

1 2 3 4 5 6 7

2. Is 1 = sketchy; 7 = very detailed

1 2 3 4 5 6 7

3. Involves visual detail 1 = little or none; 7 = a lot

1 2 3 4 5 6 7

4. Overall vividness is 1 = vague; 7 = very vivid

1 2 3 4 5 6 7

5. Order of events is 1 = confusing; 7 = comprehensible

1 2 3 4 5 6 7

6. Story line is 1 = simple; 7 = complex

1 2 3 4 5 6 7

7. Story line is 1 = bizarre; 7 = realistic

1 2 3 4 5 6 7

8. My memory for the location where the film takes place is 1 = vague; 7 = clear/distinct

1 2 3 4 5 6 7

9. General setting is 1 = unfamiliar; 7 = familiar

1 2 3 4 5 6 7

10. Relative spatial arrangement of objects in my memory for the film is
1 = vague; 7 = clear/distinct

1 2 3 4 5 6 7

11. Relative spatial arrangement of people in my memory for the film is
1 = vague; 7 = clear/distinct

1 2 3 4 5 6 7

12. My memory for the time when the film takes place is
1 = vague; 7 = clear/distinct

1 2 3 4 5 6 7

13. My memory for the year is 1 = vague; 7 = clear/distinct

1 2 3 4 5 6 7

14. My memory for the season is 1 = vague; 7 = clear/distinct

1 2 3 4 5 6 7

15. The film seems 1 = short; 7 = long

1 2 3 4 5 6 7

16. The overall tone of the memory is 1 = negative; 7 = positive

1 2 3 4 5 6 7

17. At the time, the film seemed like it would have serious implications:
1 = not at all; 7 = definitely

1 2 3 4 5 6 7

18. Looking back, the film did have serious implications: 1 = not at all; 7 = definitely

1 2 3 4 5 6 7

19. I remember how I felt at the time when the film took place:
1 = not at all; 7 = definitely

1 2 3 4 5 6 7

20. Feelings at the time were 1 = negative; 7 = positive

1 2 3 4 5 6 7

21. Feelings at the time were 1 = not intense; 7 = very intense

1 2 3 4 5 6 7

22. As I am remembering now, my feelings are 1 = not intense; 7 = very intense

1 2 3 4 5 6 7

23. I remember what I thought at the time: 1 = not at all; 7 = clearly

1 2 3 4 5 6 7

24. This memory reveals or says about me: 1 = not much; 7 = a lot

1 2 3 4 5 6 7

25. Overall, I remember the film: 1 = hardly; 7 = very well

1 2 3 4 5 6 7

26. I remember events relating to this memory that took place in advance of the film: 1 = not at all; 7 = yes, clearly

1 2 3 4 5 6 7

27. I remember events relating to this memory that took place after the film: 1 = not at all; 7 = yes, clearly

1 2 3 4 5 6 7

28. Do you have any doubts about the accuracy of your memory for the film:
1 = a great deal of doubt; 7 = no doubt whatsoever

1 2 3 4 5 6 7

29. Since I viewed it, I have thought about the film 1 = not at all; 7 = many times

1 2 3 4 5 6 7

Appendix C

Please indicate which of the following emotions were expressed in the film clip. For those that were, in a sentence, please describe when or where in the film each emotion was expressed. Also, more than one emotion may be indicated for the same scene or portion of the clip.

Acceptance		
Affection		
Anger		
Anticipation		
Anxiety		
Aversion		
Calm		
Confidence		
Contempt		
Courage		
Dejection		
Desire		
Despair		
Disgust		
Distress		
Elation		
Expectancy		
Fear		
Grief		
Guilt		
Happiness		
Hate		
Hope		
Interest		
Joy		
Love		
Nervousness		
Pain		
Panic		
Pleasure		
Pride		
Rage		
Sacredness		
Sadness		
Solemnity		
Sorrow		
Surprise		
Tenderness		
Terror		
Uneasiness		
Wonder		

Appendix D

Objective Memory Questionnaire – Alexander Nevsky

1. What was the historical date of the battle? (day/year)

2. In which season did the battle seem to take place?

3. What was the weather like on the day of the battle?

4. Was the terrain of the area separating the two sides flat or mountainous?

5. What kind of surface did the battle appear to take place upon?

6. What prominent object was being held in the very first image of the clip?

7. What symbol was most closely associated with the White side?

8. At the White side's camp, the priests *inside* the tent were dressed in Black / White and the priests *outside* of the tent were dressed in Black / White
   (Circle One)

9. Did the priest say his blessing *before* or *after* the first side began their advance into battle?

10. What was the priest holding when he delivered his blessing?

11. Was the organ-player's cloak black or white?

12. What weapons were the White horsemen wielding during their initial advance?

13. Did the soldiers of the Grey side appear to be young, old, or both?

For the following questions, please choose one of the two sides (White or Grey).

14. Which side wore cone-shaped helmets?
15. Which side seemed to have more horses?

16. Which side had soldiers stationed atop steep hills and cliffs?

17. In the film, which side was the first to speak? What was said?

18. A portion of which group(s) of soldiers had beards: White, Grey, or both?

19. The two generals of which side embraced prior to going into the battle?

20. Which side had a tent at their base?

21. Which side began their charge into battle first?

22. The shields of the _____ side were circular.

23. The shields of the _____ side were rectangular.

24. Which side had scouts stationed atop a mountain *prior* to the beginning of the battle?

25. Which side had cloaks around their horses?

26. Which side had a picture of a fierce animal on their flag?

27. Which side had a cross on their flag?

28. Which side wielded long pikes – White, Grey, or both?

29. Which side's helmets covered nearly their entire faces?

30. Just before the two sides met, a general from which side drew his sword?

Appendix E

Try to arrange the following events in the order (1-8) in which they occurred in the film:

____ The priest confers a blessing upon the soldiers.

____ The White side begins their advance.

____ Two generals embrace.

____ The two sides meet and the battle begins.

____ The Grey soldiers lower their pikes toward the enemy.

____ Stationed atop a hill, a scout holding a sword and a soldier holding a pike look off the distance.

____ The White horsemen raise their flags.

____ Two Grey horsemen take their positions in front of the Grey soldiers.

Appendix F

1. Have you previously heard any of the music presented during any part of the testing session prior to coming in today?

   Yes / No

   If so, where and when?

   _____

2. Have you previously viewed any of the video or film clips presented during the testing session prior to coming in today?

   Yes / No

   If so, where and when?

   _____

3. While initially viewing the film clip, were you consciously trying to remember any or all aspects of the film?

   Yes / No

   If so, which and why?

   _____

Finally, we would like to know some background information about you.

1. What is your age? _____
2. Male / Female _____
3. What is/are your major(s) and/or minor(s)? _____
   _____
4. What is your approximate GPA? _____
   - if N/A, what was your
   Best SAT or ACT score?

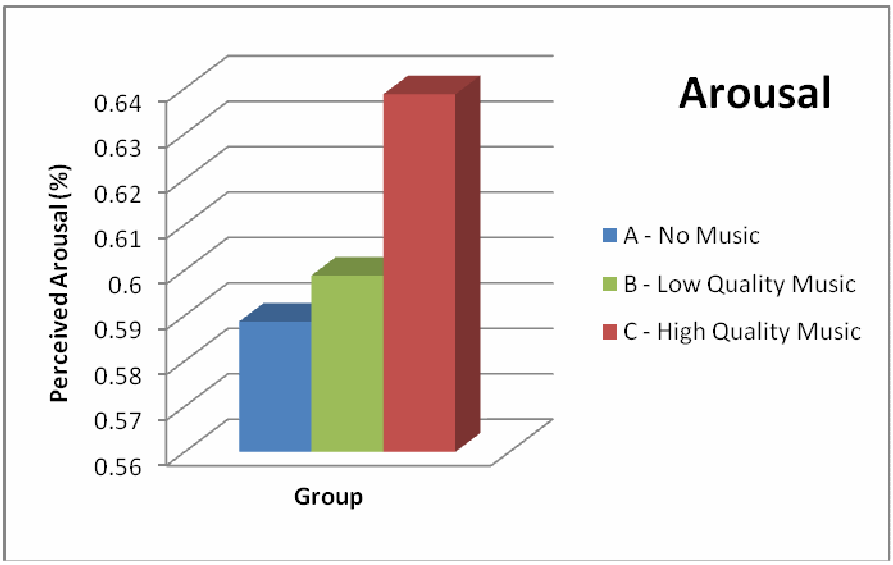
Appendix G

Arousal

Table 1

	Group A	Group B	Group C
Mean	.5886	.5988	.6387
Standard Deviation	.1160	.1051	.1409

Figure 1

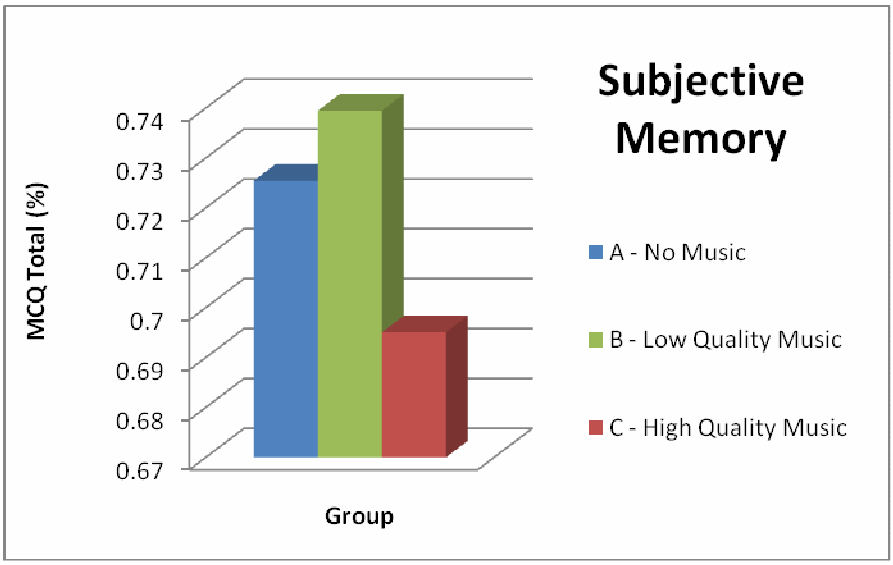


Subjective Memory

Table 2

	Group A	Group B	Group C
Mean	.7255	.7395	.6951
Standard Deviation	.1009	.1047	.0907

Figure 2

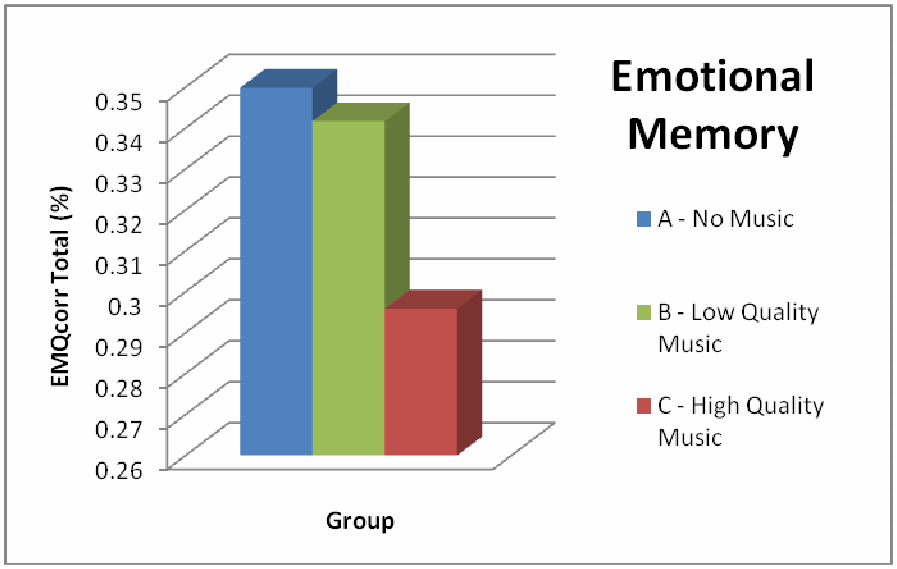


Emotional Memory

Table 3

	Group A	Group B	Group C
Mean	.3498	.3417	.2959
Standard Deviation	.1357	.1531	.1407

Figure 3

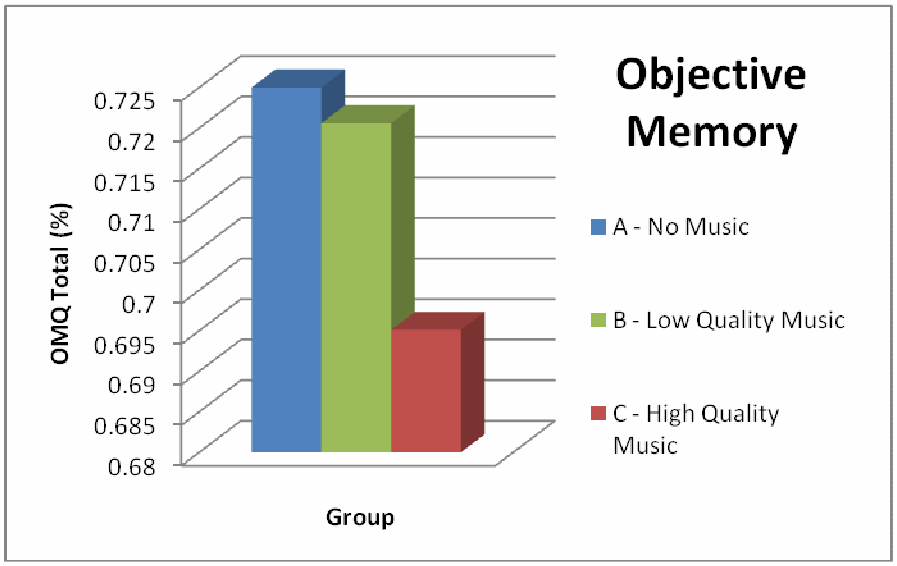


Objective Memory

Table 4

	Group A	Group B	Group C
Mean	.7250	.7206	.6951
Standard Deviation	.0811	.0933	.1094

Figure 4

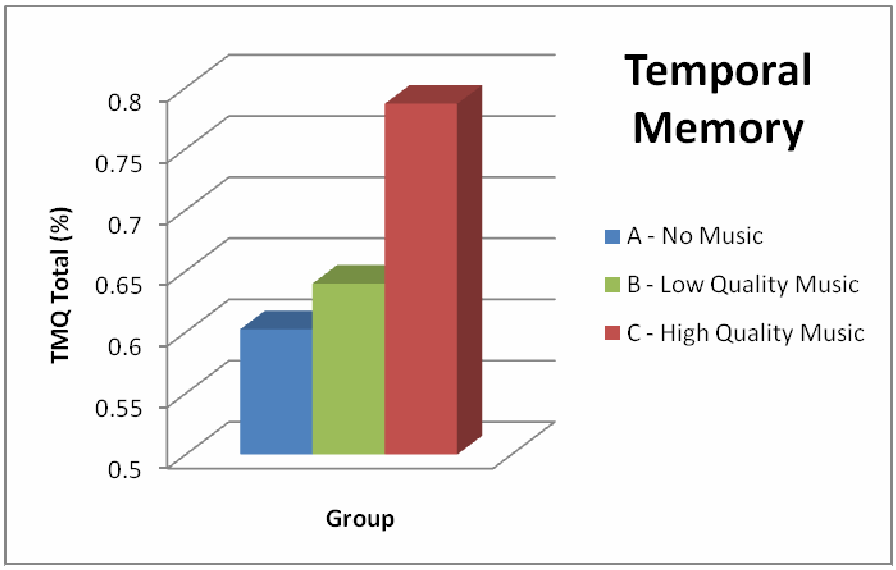


Temporal Memory

Table 5

	Group A	Group B	Group C
Mean	.6023	.6397	.7868
Standard Deviation	.2772	.2684	.2787

Figure 5


Temporal Memory
TMQ Total (%)
0.8
0.75
0.7
0.65
0.6
0.55
0.5
Group
A - No Music
B - Low Quality Music
C - High Quality Music

Appendix H

Figure 1

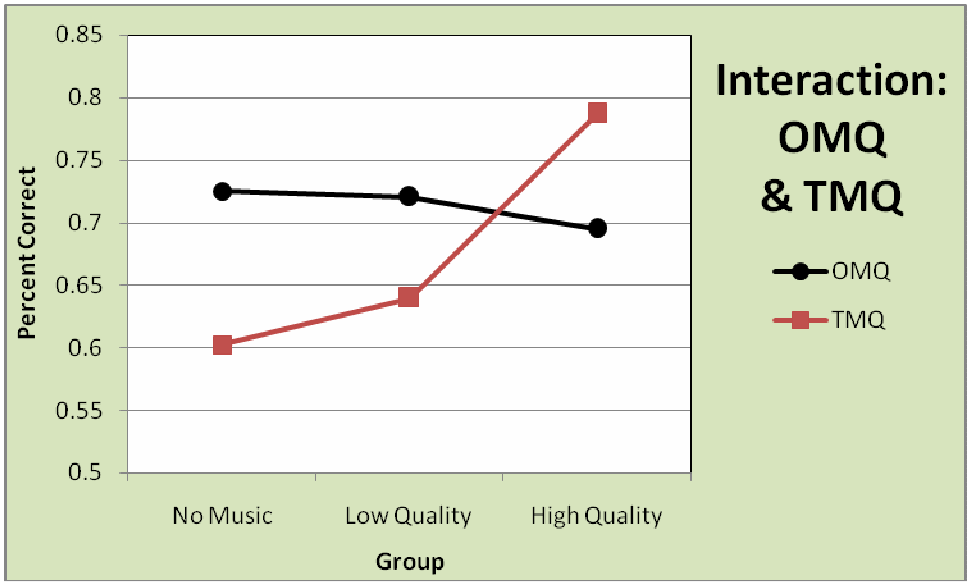


Figure 2

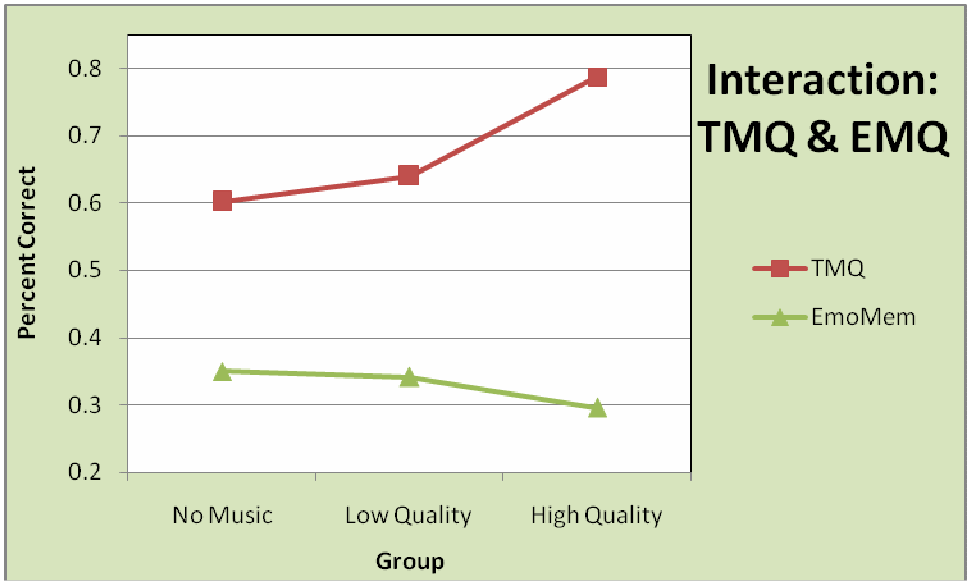


Figure 3

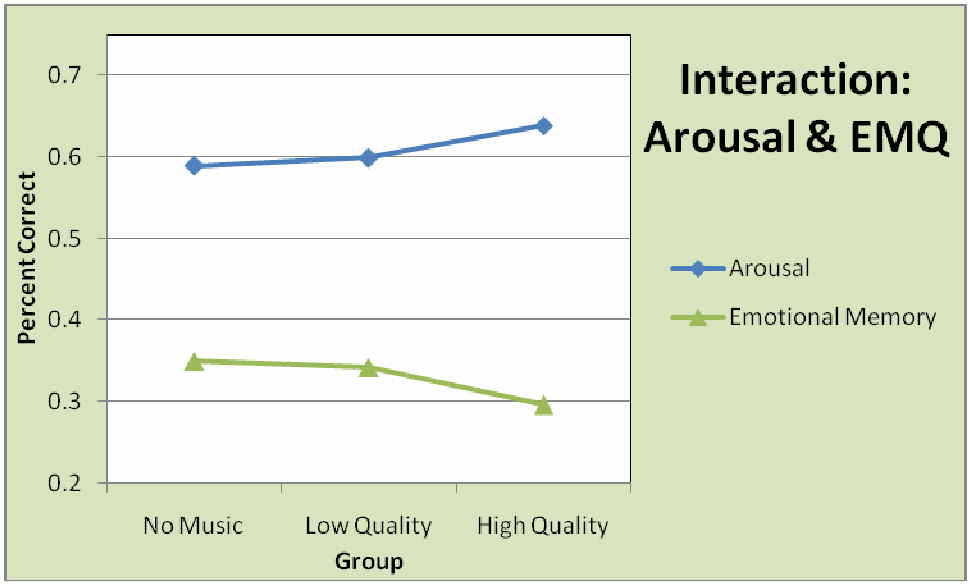
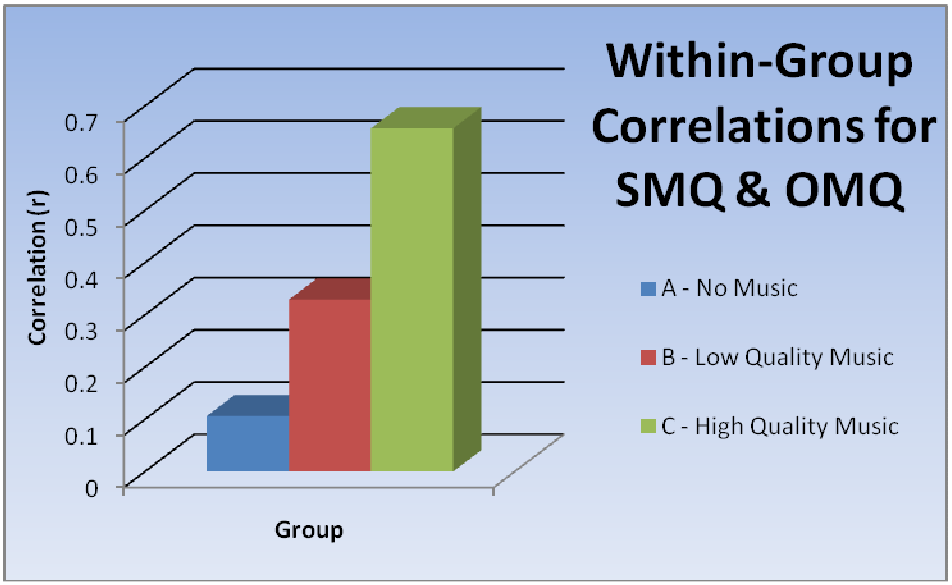

Interaction:
Arousal & EMQ
Percent Correct
0.7
0.6
0.5
0.4
0.3
0.2
No Music
Low Quality
High Quality
Group
Arousal
Emotional Memory

Figure 4


Within-Group
Correlations for
SMQ & OMQ
Correlation (r)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Group
A - No Music
B - Low Quality Music
C - High Quality Music